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## A new species of the family Turbinidae Rafinesque, 1815 from Saint Brandon, Western Indian Ocean

(Mollusca, Gastropoda, Vetigastropoda, Turbinidae)

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14 species of the genus *Turbo* are known from the Western Indian Ocean. These species are assigned to 5 subgenera. A new species of the subgenus *Aspilaturbo* Williams, 2008 was found on the remote islands of Saint Brandon (Cargados Carajos Islands). This species is described here as new and compared to the similar-looking species *Turbo radiatus* Gmelin, 1791 and *Turbo tuberculosus* Quoy & Gaimard, 1834 and to the two other species of the subgenus, *Turbo jonathani* Dekker, Moolenbeek & Dance, 1992 and *Turbo marisrubri* Kreipl & Alf, 2001.

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### Introduction

The former prosobranch superfamily Trochoidea today is divided into 4 superfamilies (Trochoidea, Angaroidea, Phasianelloidea and Seguenzioidae) based on anatomy and molecular data (Williams 2012). The Trochoidea now contain the Trochidae, Liotiidae (excluding the genera *Cinysca* and *Arene*), Turbinidae, Calliostomatidae, Margaritidae, Solariliidae, Tegulidae and Skeneidae. The Turbinidae – subject of the present paper – originally containing the trochoidean species with a solid calcareous operculum, are now defined – besides morphological features of the soft body – by the presence of a bicarinate juvenile shell and an operculum with a long growing edge (Hickman & McLean, 1990). A provisional tree of relationship in the subfamily Turbininae is pictured by Alf & Kreipl (2011b).

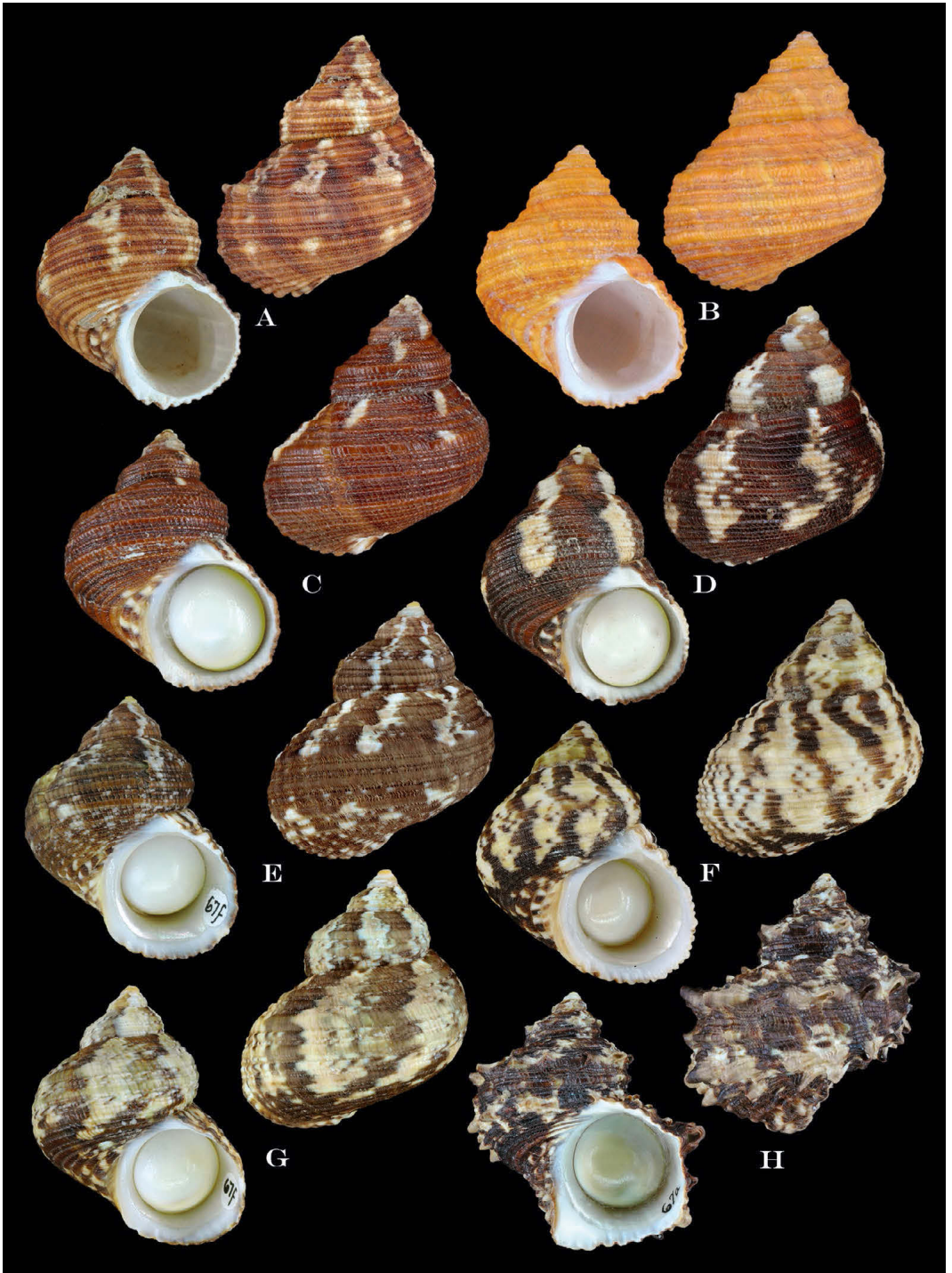
The nominotypical genus *Turbo* contains about 50 species (Alf & Kreipl 2003, 2011a), living mainly in shallow water. The highly conispiral, thick shells are between 20 and 200 mm diameter in size, can be smooth or strongly sculptured and have a great

interspecific variability of sculpture and coloration. All species of the genus have a thick calcareous operculum which perfectly fits in the aperture and protects the animal from crab attacks and desiccation. Williams (2008) showed that opercular characters can be useful to define some – but not all – subgenera of *Turbo*. Though the shell of *Turbo* species can be very variable, the operculum in most species bears constant features that allow separating the species also by morphology and coloration of the operculum.

Species of *Turbo* live in all tropical and subtropical seas, only a few species extend their range into cool temperate waters. The majority of *Turbo* species inhabit hard substrates in intertidal rocky areas, very few go down to greater depths (about 100–150 meters). All *Turbos* are herbivorous, feeding on marine algae.

From the Western Indian Ocean 14 species of the genus *Turbo* are known, belonging to 5 subgenera (Alf & Kreipl 2003, Williams 2008):

*Turbo* (*Aspilaturbo*) *jonathani* Dekker, Moolenbeek & Dance, 1992; *Turbo* (*Aspilaturbo*) *marisrubri* Kreipl & Alf, 2001; *Turbo* (*Aspilaturbo*) *radiatus* Gmelin,



**Fig. 1.** *Turbo radiatus* Gmelin, 1791. **A.** Madagascar, 46 mm (height), coll. Kreipl. **B.** Madagascar, 32 mm, coll. Kreipl. **C.** Comoros, 30 mm, coll. Kreipl. **D.** Comoros, 34 mm, coll. Kreipl. **E.** Kenya, 38 mm, coll. Alf. **F.** Comoros, 45 mm, coll. Kreipl. **G.** Kenya, 39 mm, coll. Alf. **H.** Oman, 51 mm, coll. Alf. All photographs by AA.

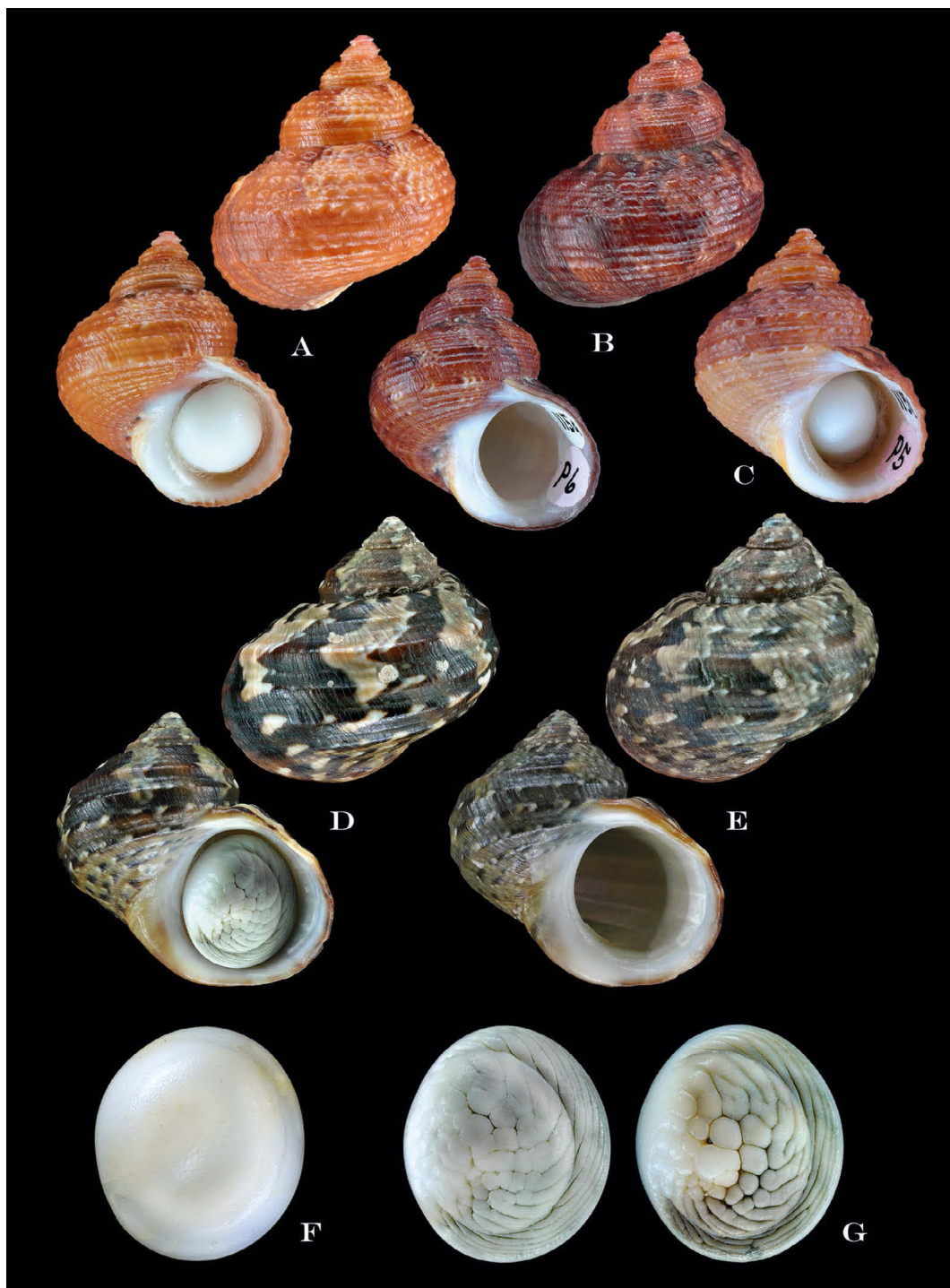


Fig. 2. A-C. *Turbo marisrubri* Kreipl & Alf, 2001. A. 21 mm (height). B. Paratype 6, 24mm. C. Paratype 5, 24 mm, all from Egypt. D-E. *Turbo jonathani* Dekker, Moolenbeek & Dance, 1992. D. 22 mm. E. 24 mm, all from Oman. F-G. Opercula. F. *Turbo marisrubri*. G. *Turbo jonathani*. All coll. Alf. All photographs by AA.



1791; *Turbo (Carswellena) laetus* Philippi, 1850; *Turbo (Carswellena) tursicus* (Reeve, 1843); *Turbo (Lunatica) imperialis* Gmelin, 1791; *Turbo (Lunatica) marmoratus* Linné, 1758; *Turbo (Marmarostoma) argyrostomus* Linné, 1758; *Turbo (Marmarostoma) cernicus* Sowerby, 1886; *Turbo (Marmarostoma) chrysostomus* Linné, 1758; *Turbo (Marmarostoma) histrio*, Reeve, 1848; *Turbo (Marmarostoma) setosus* Gmelin, 1791; *Turbo (Turbo) petholatus* Linné, 1758.

The three species presently assigned to subgenus *Aspilaturbo* Williams, 2008, all live in the Western Indian Ocean, including the Red Sea:

*Turbo radiatus* (Fig. 1) with the two forms *chemnitzianus* Reeve, 1848 and *spinosus* Gmelin, 1791, is the most widespread species, ranging from South Africa to the Red Sea, and eastwards to the Maldive Islands. Molecular research pointed out that *Turbo radiatus* possibly contains a cryptic species, but too little material was available for a final conclusion (Williams 2008). *Turbo jonathani* (Fig. 2D,E,G) and *Turbo marisrubri* (Fig. 2A–C,F) are restricted in their range. *Turbo jonathani* is only found in Oman, while *Turbo marisrubri* most probably is endemic to the Red Sea.

While molecular analyses confirm that *Turbo radiatus* and *Turbo jonathani* – though shell and operculum look quite different – can be assigned to the same subgenus (Williams & Duda 2008), *Turbo marisrubri* here is included in *Aspilaturbo* “on the basis of biogeographic pattern” (Williams 2008).

A *Turbo* species from the remote islands of Saint Brandon (also known as Cargados Carajos Islands (16°35' S, 59°37' E) situated more than 400 km north-east of Mauritius), which was collected and brought to the authors' attention by Felix Lorenz from Buseck-Beuern, Germany, turned out to be morphologically distinct from all known *Turbo* species. This species is described here as new and compared to the similar looking species *Turbo (Aspilaturbo) radiatus* and *Turbo (Marmarostoma) tuberculatus*.

The species is tentatively assigned to the subgenus *Aspilaturbo* until further information is available. The only other *Turbo* Felix Lorenz found during three visits to Saint Brandon is *Turbo (Marmarostoma) setosus* Gmelin, 1791; large eroded shells, which were mostly inhabited by crabs (pers. comm.).

## Abbreviations

H	height
W	width
MNHN	Museum National d'Histoire Naturelle, Paris, France
SMF	Senckenberg Museum Frankfurt, Germany
ZSM	Zoologische Staatssammlung München, Germany

Coll. AA private collection of Axel Alf, Weidenbach, Germany  
 Coll. KK private collection of Kurt Kreipl, Öhringen, Germany

## Systematics

### Order Vetigastropoda

Salvini-Plawen & Haszprunar, 1987

Superfamily Trochoidea Rafinesque, 1815

Family Turbinidae Rafinesque, 1815

Subfamily Turbininae Rafinesque, 1815

Genus *Turbo* Linnaeus, 1758

Type species: *Turbo petholatus* Linnaeus, 1758

Subgenus *Aspilaturbo* Williams, 2008

Type species: *jonathani* Dekker, Moolenbeek & Dance, 1992

### *Turbo (Aspilaturbo) lorenzi* spec. nov.

**Types.** Holotype (Fig. 3A; Fig. 4E, uppermost operculum): in the MNHN (MNHN 27219), H = 33.1 mm, W = 28.3 mm.

12 Paratypes: Paratype 1: in the SMF (SMF 341912), H = 27.0 mm, W = 22.9 mm; Paratype 2: coll. Felix Lorenz, Buseck-Beuern, Germany, H = 28.5 mm, W = 23.5 mm; Paratype 3: coll. KK, H = 31.3 mm, W = 27.1 mm; Paratype 4: coll. KK, H = 26.4 mm, W = 24.1 mm; Paratype 5: coll. KK, H = 26.7 mm, W = 23.5 mm; Paratype 6: coll. KK, H = 25.3 mm, W = 22.3 mm; Paratype 7: coll. KK, H = 23.5 mm, W = 20.1 mm; Paratype 8: coll. AA, H = 25.9 mm, W = 23.0 mm; Paratype 9: coll. AA, H = 22.9 mm, W = 19.6 mm; Paratype 10: coll. AA, H = 27.1 mm, W = 25.0 mm; Paratype 11: coll. AA, H = 24.1 mm, W = 21.4 mm; Paratype 12: coll. AA, H = 26.6 mm, W = 22.3 mm.

All type specimens are with original operculum, but the soft parts were not preserved as they only were dried in and partially rotten.

**Type locality.** Western Indian Ocean, Mascarenes, Saint Brandon, Coco Island (16°48'07" S, 59°32'44" E), intertidal under rocks and dead coral. *Turbo (Aspilaturbo) lorenzi* spec. nov. is possibly endemic to Saint Brandon. Live specimens all come from the south end of Coco Island. Beached shells are also found at North Island (16°19'00" S, 59°39'00" E) and Albatross Island (16°13'43" S, 59°35'15" E).

## Description

Holotype shell 33.1 mm high and 28.3 mm wide, giving a height/width ratio of 1.16. Apex partially eroded, teleoconch consisting of 5 slightly angulated whorls, with a moderately steep shoulder; shell thick and solid. Body whorl ornamented with 9 distinct

spiral cords, some of them bearing small spines, and 3 spiral cords on the shoulder. Spiral cords crossed by very fine, densely-set axial lamellae. Columella evenly curved. Umbilicus closed. Aperture well rounded. Operculum calcareous, thick, round, surface completely covered with distinct pustules. Apex white. Basic colour of teleoconch whorls creamy white, with broad axial bands of reddish-brown on the body whorl, green on the upper whorls. Base speckled with brown and orange. Columellar callus nacreous white. Operculum creamy white.

The paratypes (Fig. 3B–E) range in size from 22.9 mm to 31.3 mm height. The largest observed specimen is the holotype. The height/width ratio in the paratypes is from 1.08 to 1.21, with an average of 1.14. In some of the paratype specimens the axial colour pattern is more irregular, sometimes wavy and broader than in the holotype and showing different colours from blackish brown to reddish light brown (Fig. 3B,E). Most specimens show a darker spiral band on the central base.

## Discussion

In this paper *Turbo lorenzi* spec. nov. is provisionally assigned to the subgenus *Aspilaturbo*, as the species with the most similar shell in the Western Indian Ocean is *Turbo (Aspilaturbo) radiatus* (Fig. 1). *Turbo radiatus* is an extremely variable species concerning size, shape and coloration. Especially specimens of the form *spinus* Gmelin, 1791 (Fig. 1G) can be quite similar to *Turbo lorenzi* spec. nov., but differ in having an operculum which is completely smooth at least in the central area and of a greenish to bluish-green or yellowish coloration (Fig. 4F), while the operculum of *Turbo lorenzi* spec. nov. is pure to creamy white and has a distinct tuberculation also in the central area (Fig. 4E). The apex of *Turbo radiatus* is yellowish or orange, while the apex of *Turbo lorenzi* is white.

The two other members of the subgenus *Aspilaturbo* are easy to distinguish from *Turbo lorenzi* spec. nov.: *Turbo marisrubri* (Fig. 2A–C) has a smaller, more slender and smoother shell with knobby spiral ridges and an orange to reddish brown coloration with a weakly expressed pattering of darker blotches beneath the suture, the operculum is humped, white and weakly granulated with a distinct, flat rim along its outer margin (Fig. 2F).

*Turbo jonathani* (Fig. 2D,E) has a broader, almost smooth shell with darker coloration, the apex is brownish-grey, the operculum (Fig. 2G) is covered with large, flattened tubercles and is coloured greenish or greyish, becoming orange or white towards the inner margin, it also has a broad rim along the outer edge.

Superficially *Turbo lorenzi* spec. nov. might resemble weakly sculptured specimens of *Turbo (Marmarostoma) tuberculosus* Quoy & Gaimard, 1834 (Fig. 4A–D). But this species is restricted to the Tropical Western Pacific and the eastern Indian Ocean (Philippines through Borneo and Indonesia, Papua New Guinea to Northern and possibly North Western Australia and to New Caledonia and Tonga). Also most specimens of *Turbo tuberculosus* have a coloured operculum (rarely white) with a yellowish to brown outer edge and a brownish blotch in the central area (Fig. 4G). The apex of *Turbo tuberculosus* is yellow.

*Turbo setosus*, the only other *Turbo* species found at the Île Cocos can be distinguished from *Turbo lorenzi* spec. nov. by its sculpture of broad, smooth spiral ridges, the pattern of dark brown blotches and flames on a beige to greenish ground and the completely smooth, white operculum.

*Turbo (Aspilaturbo) lorenzi* spec. nov. is medium-sized for the subgenus, the smallest *Aspilaturbo* is *Turbo (Aspilaturbo) marisrubri* Kreipl & Alf, 2001 reaching a maximum size of about 25 mm, *jonathani* can reach 40 mm and the largest *Aspilaturbo* is *T. radiatus* with a height of about 70 mm.

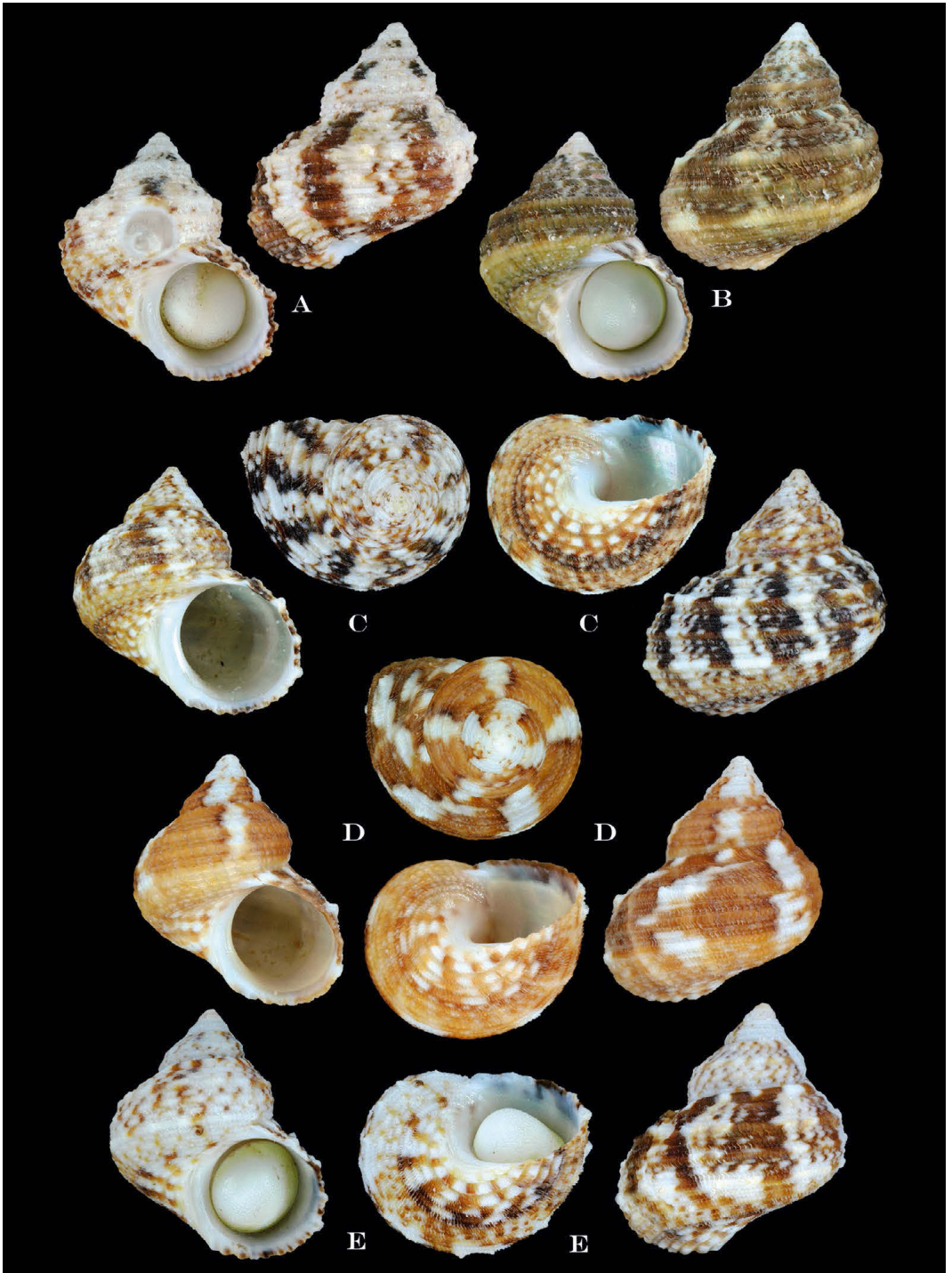
**Etymology.** This new species is named in honour of Felix Lorenz, Buseck-Beuern, Germany who brought this species to the authors' attention and donated the type specimens.

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**Fig. 3.** *Turbo lorenzi* spec. nov. **A.** Holotype (H=33.1 mm, W=28.3 mm). **B.** Paratype 3 (H=31.3 mm, W=27.1 mm). **C.** Paratype 10 (H=27.1, W=25.0 mm). **D.** Paratype 12 (H=26.6 mm, W=22.3 mm). **E.** Paratype 2 (H=28.5, W=23.5 mm). All photographs by AA.



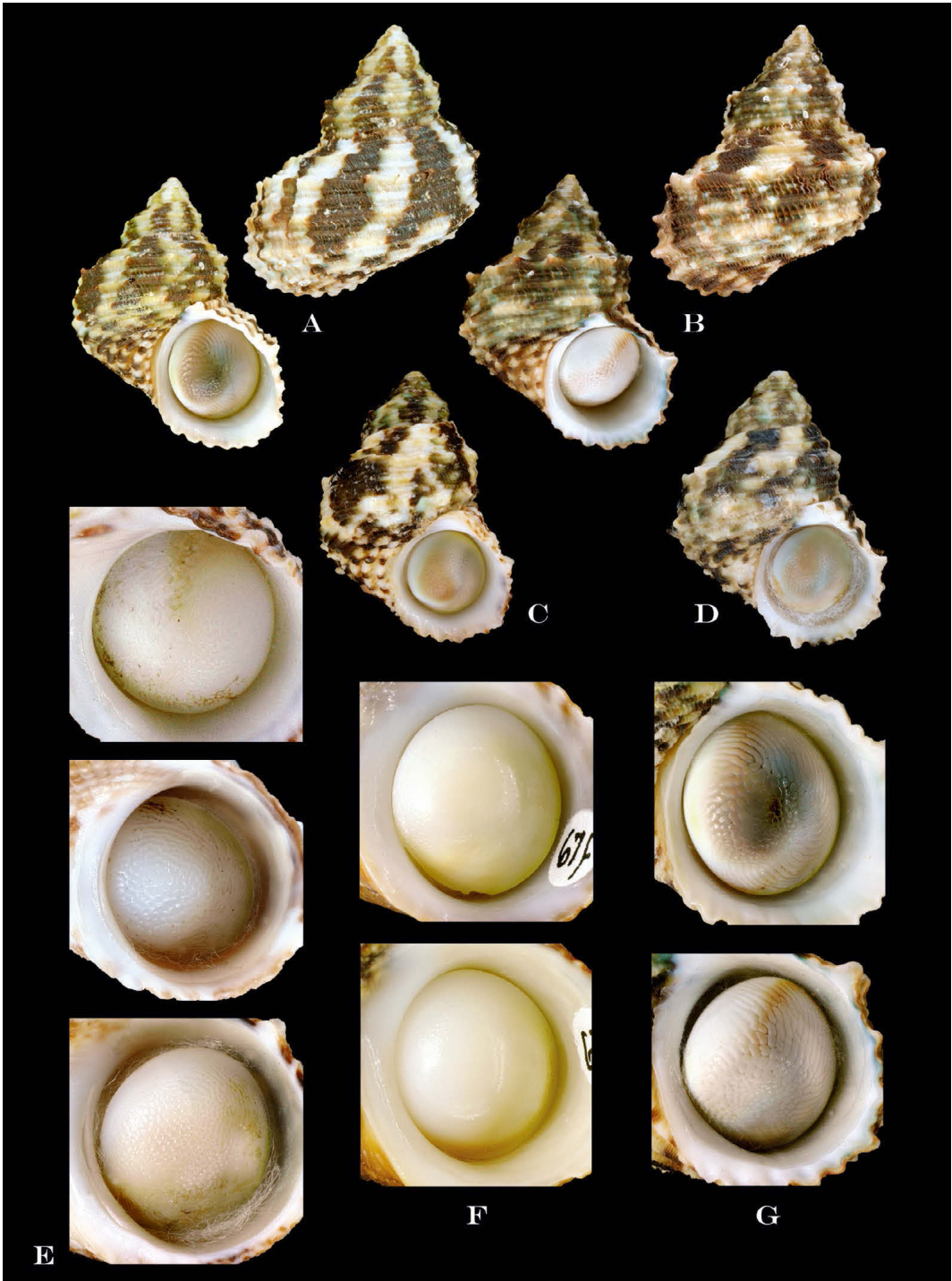


Fig. 4. A-D. *Turbo tuberculatus* Quoy & Gaimard, 1834. A. New Caledonia, 30 mm (height). B. New Caledonia, 29 mm. C. Solomon Islands, 33 mm. D. Solomon Islands, 30 mm. All coll. Alf. E-G. Opercula. E. *Turbo lorenzi* spec. nov. F. *Turbo radiatus*. G. *Turbo tuberculatus*. All photographs by AA.

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